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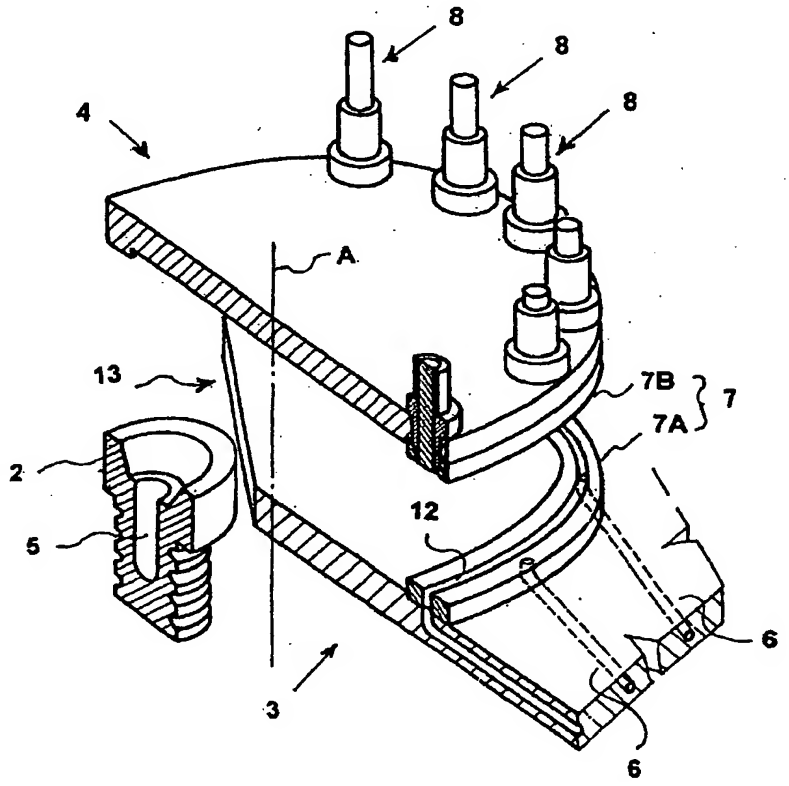
(54) Title: DEVICE AND METHOD FOR FILLING MOULDS



(57) Abstract: In a device for filling moulds for compression moulding of plastic objects, pre-set doses of fluid plastic material are introduced into dispensing devices (8) that slide over a filling channel (12). The pre-set dose is expelled from the chamber (9) of a mould (2) by lowering the piston (10). Detachment of the dose of hot plastic material from the walls of the chamber (9) is facilitated by cooling the walls themselves, which are appropriately smoothed. Likewise described is a method for carrying out filling of moulds using the device described above.

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DEVICE AND METHOD FOR FILLING MOULDS

Field of the invention

The present invention relates to a device and a method for filling moulds for the moulding of objects made of plastic material and, in particular, a device and a method for filling a mould (or a number of moulding cavities for compression moulding of plastic materials, amongst which, in particular, PET, PS, PE, PP, PVC, PEN, and PBT).

The invention may be applied, for example, in the moulding of parisons that are to be used for blow moulding of containers for foodstuffs.

Prior art

From the state of the art, there are known various methods for filling moulds for compression moulding of plastic materials. Machines or plants for compression moulding are frequently classified into two major categories: sequential machines and rotary machines.

In sequential machines, the operations of filling and moulding are carried out, in lots, according to a sequence of operations; i.e., typically, first the filling of all the cavities of a multi-cavities mould with the plastic material is performed, and then the mould, which is generally of large dimensions, is closed. Finally, the mould is opened, and a lot or batch of numerous moulded pieces is extracted.

In the machines that are commonly referred to as continuous machines, the different steps described above take place simultaneously and according to a continuous cycle in different parts of the plant. A particular type of continuous machines are the "rotary" machines, where the movement of the moulds through the steps of filling, closing and re-opening takes place on one or more turntables, which generally have a vertical axis.

In particular, compression-moulding of parisons that are to be used for the blow moulding of bottles, jars or containers made of polyethylene terephthalate (PET) for mineral water, beverages or other foodstuffs would potentially offer various advantages over the more widespread injection-moulding technique:

- lower moulding temperatures and pressures and hence a lower rate of residual acetaldehyde in the finished bottle. Acetaldehyde is frequently a cause of an unpleasant taste of apple, for example in mineral-water bottles kept in

warehouses where temperatures are very hot over long periods of time;

- elimination, on the finished parison, of the defectiveness of the point of injection, which is a cause of poor quality and of bursting of the bottles in the subsequent blowing operation and sometimes during use; and

- possibility of moulding parisons with fewer constraints on the type and quality of the PET used.

Various difficulties of realisation have up to now hampered the application of compression moulding in the production of parisons for containers made by blow moulding using high-output plants, which are typical of the production of plastic containers for foodstuffs. In sequential machines, it is easier to carry out filling of the moulds with the plastic material but, since these machines work in lots, it is difficult to combine them with the rest of the plant if this is made up of continuous machines. A known technique is, for example, to fill a mould having a number of cavities by injecting from underneath, through nozzles arranged on the bottom of each moulding cavity, a pre-determined amount of fluid plastic material. The entire half-mould then translates horizontally, all the feed nozzles being closed simultaneously in guillotine fashion. This system presents various drawbacks: the difficulty of uniform dosing of the amount of plastic material in the various cavities; the need to have moulds with a large number of moulding impressions, and hence the need to employ large-sized moulds, which can only be used with sequential machines; and the presence of non-uniform temperatures in the various moulding cavities.

There are also known machines of the continuous type, but the systems for filling the cavities of the moulds so far developed have proved complicated from the mechanical standpoint, present a slow rate of production, frequently accompanied by problems of strings caused by residual fluid plastic which adheres to the dispensing device, and also, in this case, problems of insufficiently precise dosing. The formation of strings is a particularly critical problem in the moulding of PET.

The purpose behind the present invention is to provide a device and a method for filling moulds for compression moulding which will overcome the drawbacks of the prior art referred to above.

According to a first aspect of the present invention, the above problems are solved by a device for filling moulds for the moulding of objects made of plastic material, which comprises one or more dispensing devices designed to pick up a pre-set dose of plastic material in the fluid state and to expel said dose into a mould, characterised in that it comprises thermal conditioning means, designed to keep the temperature of the surface or surfaces of the dispensing device, with which the pre-set dose of plastic material comes into contact, below a pre-set maximum value, and in that said surface or surfaces have a surface roughness not greater than an appropriate limit.

The aforesaid limit of surface roughness and the pre-set maximum temperature of the surface or surfaces of the dosing means, with which the pre-set dose of fluid plastic material comes into contact, are determined, in correlation with one another, in such a way as to facilitate detachment or release of the pre-determined dose of plastic material from said surface or surfaces during the operation of expulsion.

According to a second aspect of the present invention, the problems described above are solved by a method for filling mould cavities for moulding objects made of plastic material using a device as described above, and comprising the following operations:

- introducing, through an opening, a pre-determined dose of plastic material in the fluid state into a dispensing device; and
- expelling through the opening said pre-determined dose in the direction of a mould;

and characterised in that the temperature of the surface or surfaces of the dispensing device, with which the pre-set dose of fluid plastic material comes into contact, is kept below the top limit of temperature indicated previously.

The contact of a dose of relatively hot plasticated material with the metal walls of the chamber of the dispensing device, which are quite cool, and with appropriate surface finishing, enables expulsion of the plastic from the dispensing device without leaving any residue or undesirable strings of plastic attached to the walls of the dispensing device even when the plastic used is PET. Detachment can be performed quickly and without any need to use chemical releasing agents,

which could leave undesired residue. The dosing of the amount of plastic material deposited on the bottom of each dosing cavity is very precise and remains constant over time. Elimination or reduction of the strings of plastic prevents or limits the formation of bubbles in the mass of plastic deposited in the mould.

According to a preferred embodiment of the apparatus, a number of dispensing devices as described above are supplied simultaneously by getting them to slide sequentially along a channel fed by a plastication screw according to a path that describes the arc of a circle. Once filling is completed, the dispensing devices drop the dose of fluid plastic into the cavity of a mould to be filled. The process of filling and emptying the dispensing devices is thus performed in a continuous way and, thanks to the speed at which the dispensing devices are able to carry out filling of the moulding cavities, a device according to the present invention can advantageously and conveniently be used to feed a compression-moulding press operating according to a continuous cycle.

Further advantages that can be achieved with the present invention are the possibility of providing a device for filling moulds for compression moulding which presents a simple mechanical structure. The speed of the cycle for filling and emptying the dispensing devices, together with continuous operation, enables the design of relatively small size machines for the same production rates.

The choice of large sections for passage of the plastic material entering and exiting the dispensing devices, as well as the combination with a process of compression moulding, enables relatively low operating pressures to be achieved on the plastic as well as very high operating speeds, with the consequent advantages referred to above. Since the dispensing devices are cooled, they are easier to clean.

List of figures

Further advantages that can be achieved with the present invention will become apparent to the person skilled in the art from the detailed description of a particular embodiment described by way of non-limiting example, with reference to the attached figures, in which:

- Figure 1 is a schematic exploded and partially sectioned three-dimensional view of a filling device according to the present invention;

- Figures 2 and 3 are schematic cross-sectional views on a longitudinal plane of a detail of the device of Figure 1, with a dispensing device, prior to and during the filling step, respectively; and

- Figure 4 is a schematic cross-sectional view of the detail of Figure 2, with the dispensing device in the emptying step.

Detailed description

Figures 1 to 3 are schematic illustrations of a preferred embodiment of a device for filling one or more moulds for the production of plastic objects moulded by means of compression moulding according to the invention. This embodiment relates, in particular, to the moulding of parisons made of PET for the production of bottles, jars, containers for foodstuffs or hollow objects, but it is obvious to a person skilled in the branch that the present invention can easily be applied to the moulding of a much greater range of objects made of plastic, as well as ones made of materials other than polyethylene terephthalate, such as, for example, PS, PE, PP, PVC, PEN and PBT.

The above preferred example of embodiment comprises a plate support 3, fixed with respect to the frame of the machine, and a turntable 4, which can rotate about the vertical axis of rotation A. Positioned underneath the fixed plate support 3 and moved by means of appropriate mould-positioning means (not illustrated) is one or more half-moulds 2 for compression moulding, in each of which is made one or more moulding cavities 5 (the preferred example illustrated in Figure 1 shows a plurality of single-cavity moulds 2).

One or more channels or ducts 6, arranged inside the fixed plate 3, carry the fluid plastic material from a conventional screw-type plastication cylinder (not illustrated) to the bottom half of a swivel joint 7. The top half of said swivel joint 7 is fixed on the bottom side of the turntable 4. The swivel joint 7, as is explained in greater detail in what follows, enables a plurality of dispensing devices 8 mounted on the periphery of the turntable 4 to be filled with fluid plastic material.

Each dispensing device advantageously comprises a variable-volume cylindrical chamber 9 (Figure 3) designed to contain a pre-determined dose of fluid plastic material and within which the piston 10 can slide vertically. The piston system contributes to ensuring precision in dosing. The chambers 9 and the

pistons 10 are mounted on the turntable 4, with axes that are vertical and equidistant from the axis A-A.

According to one aspect of the present invention, the filling device comprises appropriate means of thermal conditioning, which are designed to keep the temperature of the surface or surfaces of the dispensing device 8, with which the pre-set dose of plastic material comes into contact, below a pre-determined maximum value, and the said surfaces have a surface roughness not greater than an appropriate limit. The said limit of surface roughness and the aforesaid pre-determined maximum temperature of the surface or of the surfaces of the dispensing means 8, with which the pre-set dose of fluid plastic material comes into contact, are determined, in correlation with one another, so as to facilitate, during expulsion, detachment of the pre-set dose of plastic material from said surface or surfaces, in particular, preventing or limiting the formation of strings or other residue of fluid plastic material adhering to the surfaces of the chamber 9 after expulsion of the dose.

The thermal-conditioning means are obtained, in the example illustrated in Figures 2 and 3, with cooling circuits with thermostatted water that cools, and controls the temperature of, the cylindrical walls of the chamber 9 and of the head of the piston 10.

The surface roughness of the walls of the chamber 9 and of the head of the piston 10 is determined experimentally as required in each case according to the type of plastic material that is to be moulded, as well as according to the operating temperatures, and can be obtained, for example, with processes of smoothing, polishing, lapping, or honing. Likewise, the maximum temperature that the walls of the chamber 9 and of the piston 10, with which the fluid plastic material comes into contact, can reach is appropriately fixed.

Preferably, also the temperature of the dose of fluid plastic material to be introduced into the dispensing device 8 is controlled with an appropriate system for controlling the temperature of the fluid plastic in the channel 6 (the said system is not represented in the figures).

In the present non-limiting example of embodiment, the temperature of the dose of PET to be introduced into the dispensing device 8 was kept approximately

between 250°C and 260°C, whilst the temperature of the walls of the chamber 9 and of the head of the piston 10 did not exceed approximately 60°C. The surface finish of the walls of the cylindrical chamber 9 and of the head of the piston 10 was the one obtained by polishing.

The above temperatures, together with the surface finish of the walls of the variable-volume chamber 9, in the case of PET, means that the mass of plastic will not adhere to the walls of the variable-volume chamber and, when the piston 10 is lowered by appropriate actuating means (not represented), the mass will be completely expelled in the form of a small ball without forming strings or leaving undesired residue of plastic material adhering to the walls of the chamber 9 after expulsion of the dose of fluid plastic.

The contact with the colder walls of the chamber and of the piston produces, however, a very thin film of cooled PET, which could damage the quality of the parison or in any case of the object that is subsequently moulded. For this reason, advantageously, a stay time for the plastic material in the chamber 9, which is sufficiently short, is imposed - in the region of a few tenths of a second - so that the said film will be re-absorbed because it is heated in the cavity 5 of the mould by heat that is contained in the hot mass of the dose of PET itself. The swivel joint 7 is obtained by setting, under pressure, one against another, the two halves, i.e., the top one and the bottom one, on which there are respectively made a first sliding surface 7a and a second sliding surface 7b, the said sliding surfaces 7a and 7b being made of an appropriate anti-friction material, for example, a ceramic material, which is resistant to wear and which preferably presents quite a good degree of thermal insulation.

Obtained in the first sliding surface 7a is the filling channel 12 (Figures 1 and 2), which follows a path that describes the arc of a circle and connects together, when the swivel joint 7 is closed, the different outlets of the injection channels 6. The second sliding surface 7b slides on the surface 7a, closing the feed channel 12 at the top, except for an area corresponding to the various dispensing devices 8. Each of the latter, in fact, faces a bottom opening 15 (see Figure 4) - which is made on the second sliding surface 7b - on the first sliding surface 7a and on the filling channel 12 and, as it slides along the channel 6 following upon rotation of

the turntable 4 with respect to the fixed plate 3, is filled with a pre-determined dose of fluid plastic material.

Advantageously, as will be explained in what follows, the bottom opening coincides, as regards its shape and dimensions, with the cross section of the cylindrical chamber 9 itself, and advantageously the filling channel has a length such that a number of bottom openings 15 can be simultaneously set over it so that a number of dispensing devices can traverse together, one after another, the filling channel 12 and thus be filled.

The pressure, shape and surface finish of the two surfaces 7a, 7b of the swivel joint set against one another must be such as to ensure a sufficient seal of the fluid plastic, which (see Figure 3) from the channels 6 traverses the swivel joint 7 and is injected into the chamber 9, preferably raising, with its pressure, the piston 10. In the embodiment illustrated in Figure 1, the two halves of the swivel joint 7 are the sectors of two solids of revolution having the generating circumferences with equal radius of curvature, so as to be able to be substantially set on top of one another and facing one another in each of their cross sections. The two halves 7a and 7b preferably come into contact on a flat surface. Also preferably flat is the head of the piston 10, which can slide until it arrives flush with the bottom face of the half 7b of the swivel joint, so reducing the internal volume of the chamber 9 to zero.

Preferably, the stroke of the piston 10 is limited by a suitable stroke limiter, either a mechanical one or one of another type, so as to determine with precision and constancy the amount of plastic material introduced into each chamber 9 at each filling step.

Advantageously, the stroke of the piston 10 is detected by one or more end-of-travel sensors, which are in themselves known and are not represented in the figures, for example, microswitches, photoelectric cells or other electrical or electromechanical sensors, so as to communicate to a logic unit (not represented either) the correct completion or otherwise of the filling process of each chamber 9.

Advantageously, as will be explained in greater detail in what follows, in the area of the fixed plate 3, between the first sliding surface 7a and the filling channel

12, there is set a layer of thermally insulating material 14 (Figure 2) so as to limit diffusion of the heat of the plastic material in the filling channel 12 towards the first sliding surface 7a and the turntable 4. Preferably, the said diffusion of heat is also contained by cooling the two sliding surfaces 7a, 7b, by providing appropriate cooling channels, respectively, the channels 70, made in the fixed plate 3, and the channels 70', made in the turntable 4.

In this way, the parts of the filling device that have a higher temperature (i.e., the fixed plate 3 and the injection channels 6, which are also referred to as the "hot" part) are separated thermally in a clear way from the turntable 4 and from the dispensing devices 8, which, particularly when the cylindrical chamber 9 and the piston 10 are cooled with water or other coolant, constitute the part of the filling device that has a lower temperature, i.e., the so-called "cold" part.

The fixed plate 3 is shaped so that the various dispensing devices 8, after being filled as they slide along the filling channel 12 and after sliding over a more or less short stretch of surface 7a without filling channel 12, as the rotation of the turntable 4 about the axis A proceeds, pass over an undercut area 13 of the fixed plate 3 or, alternatively, traverse a stretch of the circular path of the dispensing devices 8 in which the underlying fixed plate 3 is absent. Figure 4 is a schematic illustration of a cross section of a dispensing device 8 in an area corresponding to the area of undercut 13 and on the vertical axis of the open cavity 5 of a mould 2, which is appropriately positioned by the aforesaid mould-positioning means. In this position, the bottom aperture 15 of the chamber 9 is opened, and the piston 10 can be lowered by means of appropriate actuators - for example, fluid cylinders, mechanical cam-actuating mechanisms, etc. - so as to expel the pre-determined amount of fluid plastic material completely from the chamber 9, dropping it, in the form of a globular mass, into the cavity 5 of the half-mould 2.

Preferably, the top cross section (or mouth) of the moulding cavity 5 is equal to or greater than the cross section of the bottom opening 15 of the chamber 9, so as to facilitate introduction, by dropping, of the plastic material expelled from the dispensing devices 8 into the moulding cavities 5.

There now follows a description of the operation of the device, with reference to Figures 1 to 4.

During rotation of the aforesaid turntable 4, a pre-determined dispensing device, at a given instant, enters the angle of the swivel joint 7 and, more in particular, starts to move over the groove or channel 12 that describes the arc of a circle (see Figure 2). The plasticated material, which is injected through the channels 6 and through the bottom opening 15 of the cylindrical chamber 9, starts to raise the piston 10 on account of the pressure that is formed in the channel 12, as it flows into the cylindrical chamber 9 (Figure 3), whilst the dispensing device 8 in question continues to rotate along the groove 12. The walls of the chamber 9 and the head of the piston 10 are cooled so as to keep their temperature below a determined maximum value, as explained previously, in correlation with the roughness of the walls of the chamber 9 and of the piston 10. The speed of rotation of the top turntable 4, the pressure in the groove 12, and the calibration of the stroke limiters of the pistons are chosen so that the dispensing device 8 will be filled with the desired amount of plastic material - the said amount depending upon the mass of the object that is to be moulded - when it arrives at the end of the groove 12. After a brief dead angle beyond the end of the groove 12, in which the chamber 9 of the piston is closed by the bottom half of the swivel joint, the dispensing device proceeds in its rotation over an angular area in which the bottom half 7a of the swivel joint is absent or is undercut, the cylindrical chamber 9 remains opened at the bottom, and the piston 10 is lowered - by means of an appropriate device- a cam mechanism, a piston, or some other mechanism -, so dropping the dose of fluid plastic through the undercut area 13 of the fixed support 3 into the cavity 5 of a half-mould 2, which had previously been positioned under the opening of the cylindrical chamber 9 (Figure 4) by the aforesaid mould-positioning means (not shown). The half-mould 2 is then ready for the subsequent operation of closing of the mould and for completion of the compression-moulding cycle.

In the instants prior to lowering of the piston 10, in which the bottom opening 15 of the chamber 9 is already open, the molten plastic material is preferably contained inside the chamber 9 as a result of the external atmospheric pressure.

The fact that the bottom opening 15 of the cylindrical chamber 9 is substantially equal to the cross section of the chamber 9 itself reduces the energy

dissipated by friction during filling of the chamber 9, and, in particular, contributes, together with the contact of the fluid plastic with the cold walls of the chamber 9, to facilitating expulsion of the dose of plastic, without leaving any residue on the walls of the chamber 9, thus enabling the emptying operations to be speeded up considerably.

Also the layer of insulating material 14, which thermally insulates the hot part and the cold part of the fixed plate 3 (and, respectively, separates the higher temperatures of the plastication and injection part from the lower temperatures of the second turntable 4 and the dispensing devices 8) facilitates release and expulsion, without any localised problems of adherence of the dose of plastic, so contributing to maintaining, thanks to the water-cooling circuit, the clear difference of temperature described above, between the hotter fluid plastic (250 -280°C) and the cooler walls of the chamber 9 (50-60°C) along the entire wall of the chamber 9 itself.

Advantageously, a number of dispensing devices simultaneously travel, one after the other (as illustrated in Figure 1) along the filling channel 12, so that one dispensing device 8 has already started to fill when the filling of the dispensing device in front of it has not yet terminated, according to a continuous operation of the set of dispensing devices 8. Likewise, with a continuous operation, a plurality of half-moulds 2 is filled and can readily be sent on to a compression-moulding machine, which is also operating according to a continuous cycle.

Furthermore, with the device described herein, the amount of plastic material deposited at each dose in the moulds may even be considerable and even reach 50-100 grams.

The example of embodiment described above may undergo various modifications and may, in particular, be applied to the moulding of objects that are not necessarily parisons for blow moulding of bottles made of plastic materials. The half-moulds 2 may even be moulds with a number of moulding cavities 5. The dispensing devices 8, the mobile top plate 4, and the filling channel 12 may be adapted to carry out filling with a sequential mode of operation, i.e., by lots , instead of continuous.

CLAIMS

1) A device for filling moulds for moulding plastic objects, comprising one or more dosing devices (8) suitable to take a pre-set dose of plastic material in the fluid state and to expel said dose into a mould (2), characterised in that it comprises thermic conditioning means, suitable to keep the temperature of the surface or surfaces of said dosing device (8), with which the pre-set dose of plastic material comes into contact, below a pre-set maximum value, and in that said surface or surfaces have a surface roughness not greater than an appropriate limit.

2) Device according to Claim 1, wherein said surface roughness is obtained via a polishing process.

3) Device according to Claim 1, wherein each of said dispensing device (8) comprises a variable-volume cylindrical chamber (9), suitable to contain said pre-determined dose of fluid plastic material, and in that it comprises a first sliding surface (7a), defining a filling channel (12) that communicates with plastication means, covered by a second sliding surface (7b) defining one or more openings (15) which communicate, respectively, with each of said variable-volume cylindrical chamber (9) and face said filling channel (12), said first sliding surface (7a) and said second sliding surface (7b) being adapted to slide with respect to one another.

4) Device according to Claim 3, wherein said chamber (9) has a cylindrical shape, and the section of said opening (15) is substantially equal to the cross section of said chamber (9).

5) Device according to Claim 3, wherein said filling channel (12) describes an arc of a circle, and said second sliding surface (7b) is suitable to slide on said first sliding surface (7a), performing a rotation.

6) Device according to one or more Claims from 3 to 5, wherein said second sliding surface (7b) is suitable to bring each of said opening (15) in succession, after the latter has been displaced along said filling channel (12), into a position in which said opening (15) is uncovered and through it said pre-set dose of plastic can be expelled.

7) Device according to one or more Claims from 3 to 6, wherein it comprises a plurality of said dispensing devices (8), arranged in such a way that more than one

dispensing device (8) can simultaneously face said filling channel (12) so as to be filled.

8) Device according to one or more Claims from 3 to 7, wherein each of said variable-volume cylindrical chamber (9) comprises a piston (10) suitable to slide in said chamber (9).

9) A method for filling moulds for moulding plastic objects using a device according to any one of the preceding claims, characterised in that it comprises the following steps:

- introducing, through said opening (15), said pre-determined dose of plastic material in the fluid state into one of said dispensing devices (8); and
- expelling through said opening (15) said pre-determined dose towards a mould (2);

whereby the temperature of the surface or surfaces of said dispensing device (8), with which said pre-set dose of fluid plastic material comes into contact, is kept below said pre-set maximum value of temperature according to Claim 1.

10) Method according to Claim 9, wherein said pre-set maximum value of temperature, below which the temperature of said surfaces of said dispensing device (8) with which the dose of fluid plastic material comes into contact, must be kept, is between 50°C and 60°C.

11) Method according to Claim 9, wherein said pre-set dose of plastic material in the fluid state is introduced into said dosing device (8) at a temperature of between approximately 250°C and approximately 280°C.

12) Method according to Claim 9, wherein one or more of said chambers of variable volume (9) are filled each with a pre-set dose of the plastic material in the fluid state, causing the respective openings (15) to slide along and over a filling channel (12) made in a first sliding surface (7a).

13) Method according to Claim 12, wherein the piston (10), during filling of the cylindrical chamber (9), is raised as a result of the pressure of the fluid plastic material that flows towards it.

14) Method according to any one of Claims 9 to 13, wherein two or more dispensing devices (8) are filled, sliding one behind another above said filling

channel (12), where each dispensing device (8) starts to be filled before the filling of the dispensing device that precedes it has terminated.

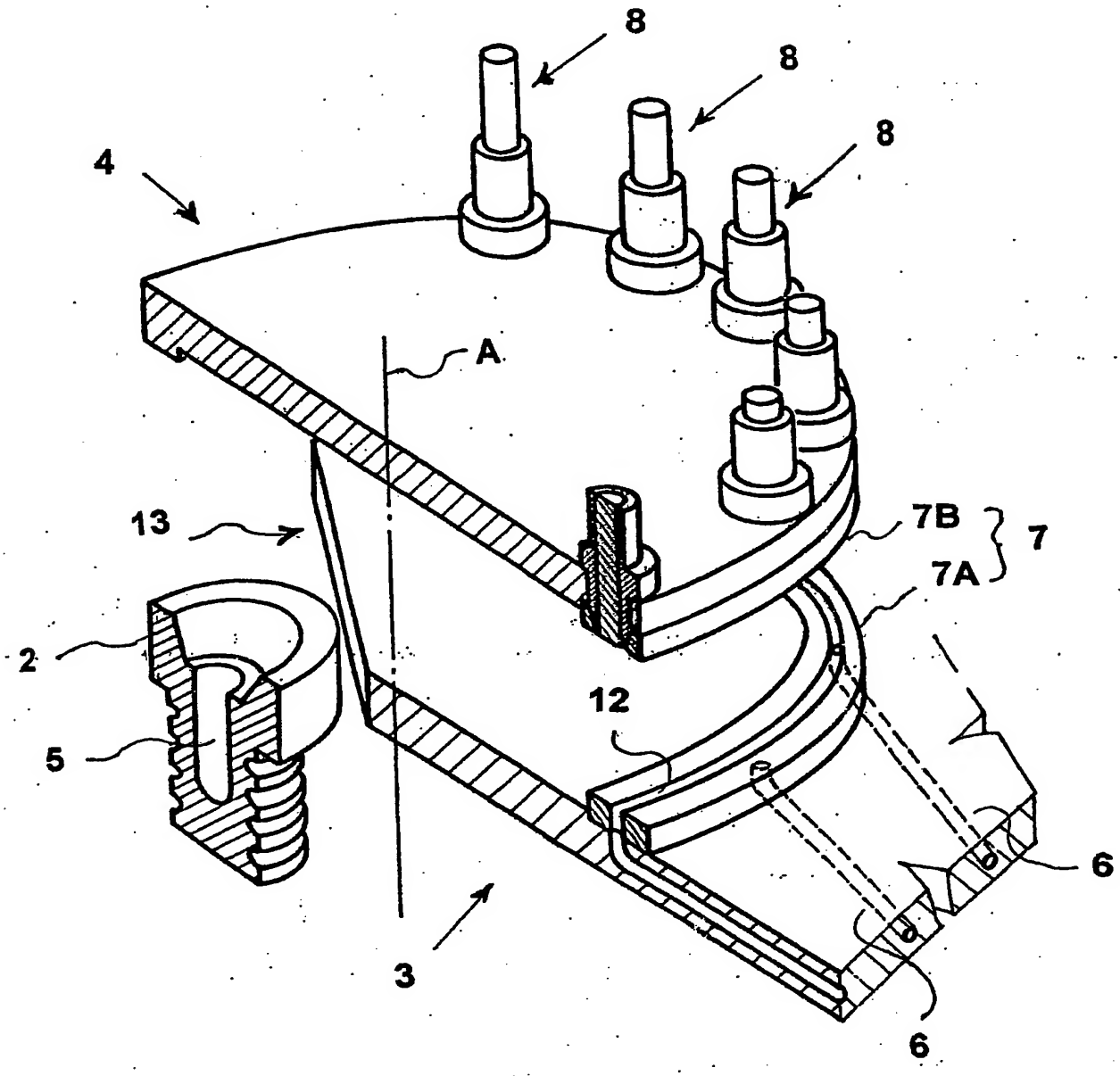

Fig. 1

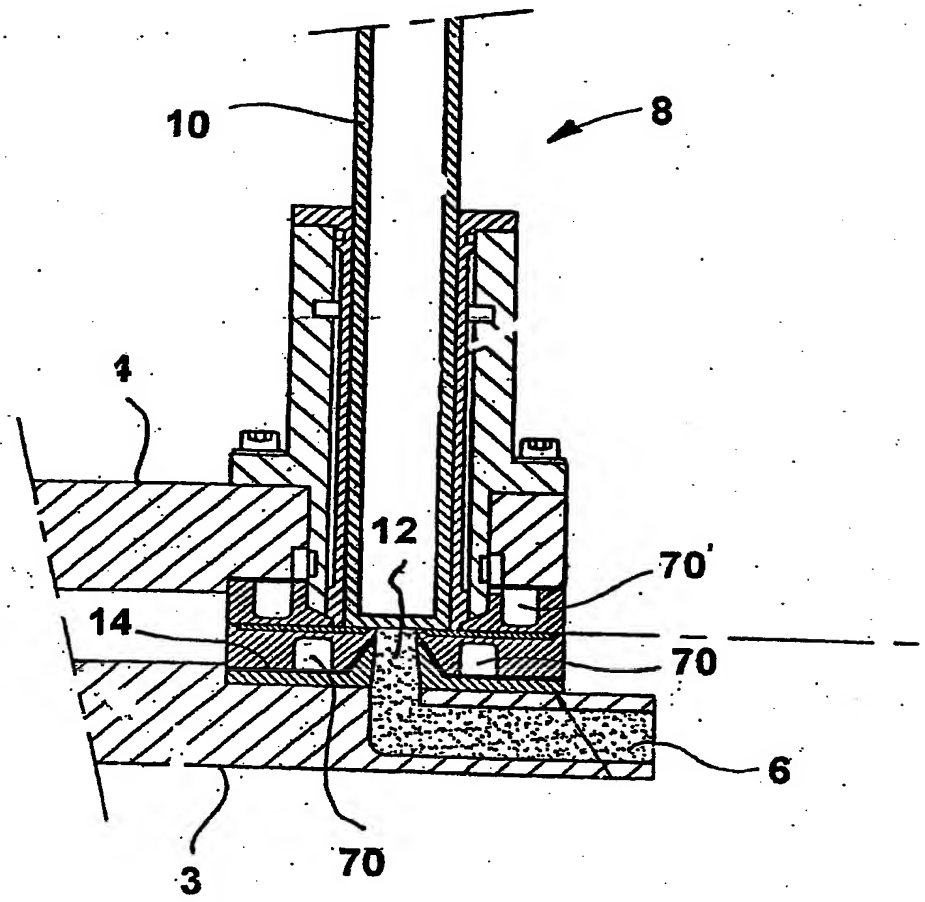

Fig. 2

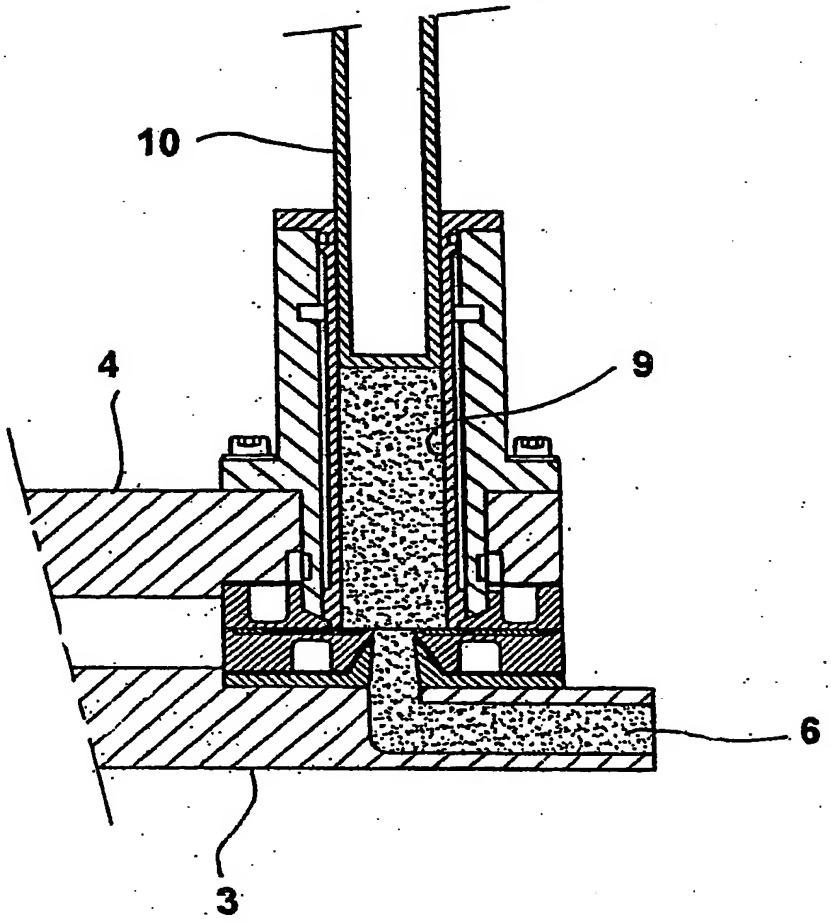

Fig. 3

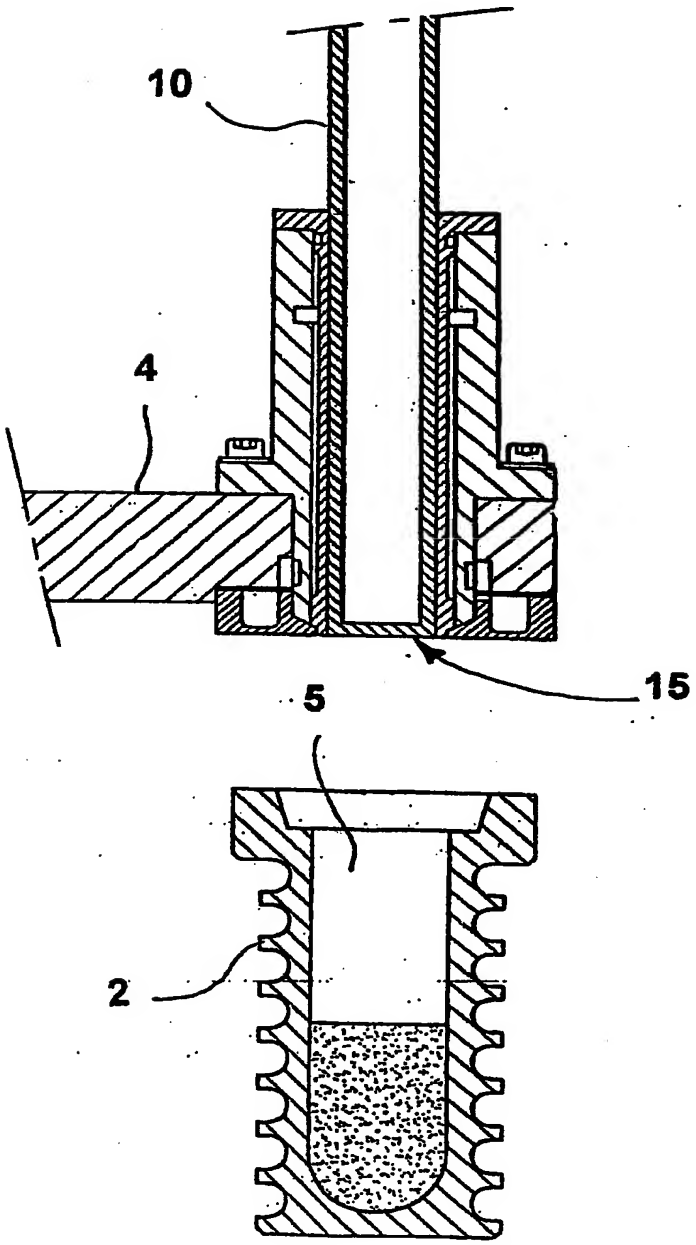

Fig. 4

INTERNATIONAL SEARCH REPORT

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A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 B29C31/06 B29C31/04 //B29C43/08,B29C43/34,B29C43/52

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 B29C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, WPI Data, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5 811 044 A (ROTE B JACK ET AL) 22 September 1998 (1998-09-22) column 2, line 34 -column 3, line 45; figures ---	1-14
X Y	US 3 360 827 A (AICHELE MARIE K) 2 January 1968 (1968-01-02) column 3, line 60 -column 4, line 6; figure 4 ---	1,8-11 2-7, 12-14
Y	US 5 807 592 A (ALIERI RODIERO) 15 September 1998 (1998-09-15) column 3, line 63 -column 4, line 6; figures 2,3 --- -/--	2-7, 12-14

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
11 April 2003	25/04/2003

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Topalidis, A

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INTERNATIONAL SEARCH REPORT

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A	GB 805 022 A (CONTINENTAL CAN CO) 26 November 1958 (1958-11-26) page 8, line 55 - line 85; figures	1,8
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A	US 5 643 620 A (BRUN JR CHARLES J) 1 July 1997 (1997-07-01) column 5, line 14 - line 63; figure 1	2-7, 12-14

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